

ORIGINAL ARTICLE

Estimation of lung cancer burden in Australia, the Philippines, and Singapore: an evaluation of disability adjusted life years

Suman Morampudi, Neha Das, Arun Gowda, Anand Patil
Phamax Analytic Resources Pvt. Ltd., Bengaluru 560095, India

ABSTRACT

Objective: Lung cancer is one of the leading cancers and major causes of cancer mortality worldwide. The economic burden associated with the high mortality of lung cancer is high, which accounts for nearly \$180 billion on a global scale in 2008. This paper aims to understand the economic burden of lung cancer in terms of disability adjusted life years (DALY) in Australia, the Philippines, and Singapore.

Methods: The years of life lost (YLL) and years lost due to disability (YLD) were calculated using the formula developed by Murray and Lopez in 1996 as part of a comprehensive assessment of mortality and disability for diseases, injuries and risk factors in 1990 and projected to 2020. The same formula is represented in the Global Burden of Disease template provided by the World Health Organization. Appropriate assumptions were made when data were unavailable and projections were performed using regression analysis to obtain data for 2015.

Results: The total DALYs due to lung cancer in Australia, the Philippines, and Singapore were 91,695, 38,584, and 12,435, respectively, and the corresponding DALY rates per a population of 1,000 were 4.0, 0.4, and 2.2, respectively, with a discount rate of 3%. When researchers calculated DALYs without the discount rate, the burden of disease increased substantially; the DALYs were 117,438 in Australia, 50,977 in the Philippines, and 16,379 in Singapore. Overall, YLL or premature death accounted for more than 95% of DALYs in these countries.

Conclusions: Strategies for prevention, early diagnosis, and prompt treatment must be devised for diseases where the major burden is due to mortality.

KEYWORDS

Lung cancer; DALY; YLD; YLL; burden of disease; DALY rate; discount rate

Introduction

Lung cancer is one of the leading cancers worldwide, with an estimated 1.8 million new cases recorded in 2012¹. According to the World Health Organization (WHO), lung cancer accounted for approximately 1.59 million cases of the 8.2 million cancer-related deaths reported in 2012; as such, lung cancer is one of the most significant causes of deaths worldwide¹. Lung cancer is also the leading cancer among men and the third most common cancer type among women. The incidence rate of lung cancer worldwide varies between 0.8 and 53.5 cases per 100,000 population; the rate is high in Central Europe, Eastern Europe, and Eastern Asia and low in the Middle and West Africa¹. Global estimates show that the age-standardized incidence rates of lung cancer are the

highest in Central and Eastern Europe and Eastern Asia, with 53.5 and 50.4 cases per 100,000 people, respectively¹. Low age-standardized incidence rates of lung cancer among men (2.0 and 1.7 per 100,000, respectively) and women (1.1 and 0.8 per 100,000, respectively) were reported in Middle and West Africa¹.

Epidemiologic studies suggest that lung cancer is the fifth most common cancer in Australia and the most common cause of cancer-attributable death among people aged 45-64 years². In the Philippines, lung cancer is the most common cause of cancer-related mortality among men and the third most common cause of mortality and morbidity³. In Singapore, lung cancer is the second most common cancer in males and the third most common cancer in females, with reported lung cancer incidence rates of 16.2% in men and 7.7% among all cancer cases⁴.

Cancers account for the highest economic loss among the 15 leading causes of death worldwide. The total global economic loss incurred because of cancer burden was estimated to be \$895 billion in 2008, which is 1.5% of the gross domestic product (GDP) worldwide⁵. Cancers of the

Correspondence to: Suman Morampudi
E-mail: suman.morampudi@fs-researchcenter.com
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lung, bronchus, and trachea conferred the major economic burden, accounting for nearly \$180 billion on a global scale in 2008⁵. The numbers are expected given that smokers die 15 years earlier than non-smokers on an average. The majority of lung cancer cases are reported in the middle aged and elderly population as a result of the increasing prevalence of smoking among young adults in the Asia-Pacific region⁶. Cancer symptoms require 10-30 years to develop; as such, the years of life lost or loss of productivity caused by cancer is a huge drain not only to the individual but also to the economy of these societies⁶. Despite epidemiologic studies suggesting that the incidence of lung cancer is relatively lower in the Asia-Pacific than that in the North America and Europe, recent studies show that the burden imposed by lung cancer on the health systems is enormous in the former. Furthermore, epidemiologic studies evaluating the true burden of lung cancer are insufficient in the Asia-Pacific region³⁻⁶.

This paper aims to understand the burden of lung cancer in three Asia-Pacific countries: Australia, Singapore, and the Philippines, and the burden of lung cancer is evaluated by understanding the economic loss caused by premature mortality and morbidity. To estimate the burden of lung cancer in Australia, the Philippines, and Singapore, we measure disability adjusted life year (DALY), which is calculated using years of life lost (YLL) and years lost due to disability (YLD). One DALY loss indicates the loss of 1 year of healthy life; thus, the total DALY in the entire population indicates the difference between the ideal healthy status without disease or disability and the current state. DALY is a sum of YLL caused by premature death and YLD. In simple terms, YLL represents the total number of lives lost prematurely because of early death caused by the disease. YLD represents the years lost due to disability and considers disability weightage, which reflects the severity of the disease on a scale of 0 (perfect health) to 1 (dead)⁷.

Methods

YLL and YLD were calculated using the formula developed by Lopez and Murray, as follows⁸:

$$\text{YLLs } [r, K, \beta] = \frac{K C e^{r a}}{(r + \beta)^2} \left\{ e^{-(r+\beta)(L+a)} [-(r + \beta)(L + a) - 1] - e^{-(r+\beta)a} [-(r + \beta)a - 1] \right\} + \frac{1 - K}{r} (1 - e^{-rL})$$

K=age weighting modulation factor; *C*=constant; *r*=discount rate; *a*=age of death; *b*=parameter from the age weighting function; *L*=standard expectation of life at age *a*.

$$\text{YLDs } [r, K, \beta] = D \left\{ \frac{K C e^{r a}}{(r + \beta)^2} \left\{ e^{-(r+\beta)(L+a)} [-(r + \beta)(L + a) - 1] - e^{-(r+\beta)a} [-(r + \beta)a - 1] \right\} + \frac{1 - K}{r} (1 - e^{-rL}) \right\}$$

K=age weighting modulation factor; *C*=constant; *r*=discount rate; *a*=age of onset of disability; *b*=parameter from the age weighting function; *L*=duration of disability; *D*=disability weight.

The same formula is represented in the Global Burden of Disease (GBD) template provided by the WHO⁹. This formula uses the values defined in the WHO template, where the international standard discount rate is 0.03, *K*-values are 0 when no age weights are used and 1 when age weights are used; the standard age weights use a beta of 0.04 and a constant of 0.1658^{8,10}. However, the *K*-value was set to 0 because no age weights were used in the present study. The value of *D* was considered as 0.146 according to the WHO statistics and information system⁹. Although recent GBD studies did not apply age weights or discounts, the authors decided to use DALY calculations with discount rates; the US Panel on Cost-Effectiveness in Health and Medicine recommended the use of a 3% real discount rate to adjust both costs and health outcomes in economic analysis of health¹¹. Moreover, numerous studies used discounts to calculate DALYs considering that the WHO reported time-discounted and age-weighted DALYs as their standards. Therefore, in the present study, the authors decided to compute DALYs with and without discounts so the results could be compared with those of other international studies.

Data

Population data for the three countries were sourced from the US Census Bureau¹². The CI5plus database, which provides age- and sex-specific incidence data of cancer, was used to source diagnosed incident cases of lung cancer¹³. The CI5plus database, which was established by the International Agency for Research on Cancer, contains the updated annual incidence rates for all cancers up to 2007 in 118 selected populations worldwide¹³. The database is considered the gold-standard source for international cancer data and statistics because of its ability to provide validated annual incidence data, which can be used to compare accessible cancer incidence data among countries worldwide (Table 1)¹³. First, age- and sex-specific incidence rates for lung cancer from 2003 to 2007 were extracted. Regression analysis was then applied to the 5-year historical data obtained from CI5plus to calculate age- and sex-specific incidence rates

Table 1 Sources for lung cancer incidence data in Australia, the Philippines and Singapore

Country	Author	Data calculated/obtained (2015) (Total No. of cases)	Study period	Study location	Study population
Australia	Ferlay et al., 2014	7,479 in men and 5,699 in women	2003-2007	Six registries, Australia	Men and women of all ages
The Philippines	Ferlay et al., 2014	12,352 in men and 5,209 in women	2003-2007	Manila, the Philippines	Men and women of all ages
Singapore	Ferlay et al., 2014	939 in men and 622 in women	2003-2007	Singapore	Men and women of all ages

until 2015. In the absence of reliable evidence for change in trends in a specific age-group or in instances where researchers reported relatively stable trends, the incidence rate reported in the most recent year was kept constant throughout the forecast period. When regression analysis showed a decreasing/increasing trend that resulted in negative values or steep decline/incline in the incidence rate over the forecast period, the incidence rate reported/calculated in the most recent year was maintained constant throughout the forecast period.

We obtained incidence data from cancer registries and population-based studies published in peer-reviewed journals. The absolute number of lung cancer incident cases in each country were obtained by multiplying the age- and sex-specific incidence rates of lung cancer with the corresponding age and sex-specific population estimates. The calculated age-specific incident cases among men and women in each country were added to obtain the total diagnosed incident cases of lung cancer among men and women in each country.

Population-based studies or country-specific cancer registries were used to collect 5-year survival rates for lung cancer in each country (**Table 2**). A report by the Australian Institute of Health and Welfare Canberra was used to determine lung cancer survival rates for Australia.¹⁴ For Singapore, lung cancer survival data for 1, 3, and 5 years were obtained from Cancer Survival data in Africa, Asia, the Caribbean, and Central America.¹⁵ Similarly, lung cancer survival data for 1, 3, and 5 years in the Philippines were obtained from a journal article titled "Cancer and the Philippine Cancer Control Program."³ Moreover, 2- and 4-year survival rates for Singapore and the Philippines were calculated by taking the average of the 1- and 3-year as well as 3- and 5-year data, respectively.

The 5-year survival rates obtained in the most recent year were kept constant throughout the forecast period because of lack of sufficient historical or contemporary data in each country. The survival rates for lung cancer in these countries were assumed not to have undergone any significant changes. The 5-year prevalent cases in each country were calculated

Table 2 Survival data

Country	Author	Data obtained (2015) (%)	Data calculated (2015) (%)
Australia	Lung cancer in Australia - an overview. Australian Institute of Health and Welfare. Cancer Series Number 64. November 2011	Survival (2000-2007 data): 1 year: 34.2 (men), 39.8 (women) 2 year: 20.1 (men), 25.3 (women) 3 year: 15.3 (men), 19.7 (women) 4 year: 12.8 (men), 16.9 (women) 5 year: 11.3 (men), 15.0 (women)	None
The Philippines	Ngelangel CA, Wang EHM. Cancer and the Philippine Cancer Control Program. Jpn J Clin Oncol 2002; 32 (Suppl 1): S52-S61.	1 year: 27.7% 3 year: 11.1% 5 year: 7.2%	2 year: 19.4% 4 year: 9.15% 2 year survival by averaging 1 and 3 year survival 4 year survival by averaging 3 and 5 year survival
Singapore		1 year: 30.2 3 year: 10.1 5 year: 7.2	2 year: 20.15 4 year: 8.65 2 year survival by averaging 1 and 3 year survival 4 year survival by averaging 3 and 5 year survival

using incident case data and relative survival data through a life-table method. The 1-year relative survival rate was applied to the total number of diagnosed incident cases for a specific year to obtain the expected number of cases that survived within that year. The 2-year relative survival rate was applied to the total number of diagnosed incident cases that were diagnosed 1-year ago to determine the expected number of cases that survived until year two. The same process was repeated to obtain 3-, 4-, and 5-year survival rates. Thus, the obtained 1- to 5-year prevalent cases in each year were added to obtain the 5-year prevalent cases of lung cancer in each country. The 5-year prevalence of lung cancer in each year was determined by dividing the calculated 5-year prevalent cases with the population estimates for that year. Considering that the 5-year survival rate varies by stages of lung cancer and data on the stage-specific survival rates of lung cancer for each year are not available from epidemiologic studies worldwide, researchers calculated the duration of disability based on incidence and prevalence rates to maintain uniform methodology across the countries¹⁶:

Prevalence=(Incidence Rate)×(Average Duration of Disease)

The duration of lung cancer in each year was obtained by dividing the 5-year prevalence in each year with the incidence rate for that year. Life expectancy is a critical aspect for calculation of YLDs; hence, constant life expectancy rates of 82.5 years at birth for women and 80 years at birth for men were maintained in each of the three countries¹⁷.

Researchers obtained the age- specific crude mortality rates for each country from country-specific sources because YLL calculation requires age-specific crude mortality cases (Table 3). Age-specific mortality rates were available from 2003 to 2013 for Australia¹⁸. Regression was then applied to the historical data to forecast the mortality cases of lung cancer in Australia during the forecast years. However, for Singapore and the Philippines, the studies provided overall

mortality rates and not age-specific mortality rates for 2009-2013 and 2010, respectively^{19,20}. To calculate the age-specific mortality rates in Singapore and the Philippines, researchers obtained the weights of age-specific mortality rates to the overall mortality rate in Australia. Researchers then applied these weights to the overall mortality rate in Singapore and the Philippines to obtain the age-specific mortality rates in these countries.

Results

The values of the burden of disease caused by lung cancer in 2015 in Australia, the Philippines, and Singapore were 91,695; 38,584; and 12,435 DALYs, respectively, as per a discount rate of 3% (Table 4). Australia presented the highest burden of disease caused by lung cancer. The DALY rate in Australia was 4.0 DALYs per 1,000 person-years, with the calculated burden of disease being the highest among people aged 45-79 years. Individuals aged 45-59, 60-69, and 70-79 years had 4.4, 12.6, and 18.5 DALYs per 1,000 person-years, respectively. This trend of increase in DALYs with increase in age from 45-79 years was also evident in the Philippines and Singapore. Although the Philippines presented the second highest calculated burden of lung cancer, the DALY rate was higher in Singapore (2.2 DALYs per 1,000 person-years) than that in the Philippines (0.4 DALYs per 1,000 person-years) (Figures 1-3).

When researchers calculated DALYs without a discount rate, the burden of disease increased substantially in these countries, with 117,438 DALYs in Australia, 50,977 in the Philippines, and 16,379 in Singapore (Table 5). Australia demonstrated the highest burden of disease caused by lung cancer even when the DALYs were calculated without using a discount rate. The DALY rate in Australia was 5.2 DALYs per 1,000 person-years, with the calculated burden of disease being the highest among people aged 70-79 years (21.8

Table 3 Mortality rate of lung cancer

Country	Report	Data obtained/calculated (cases per 1,000 population)
Australia	Australian Institute of Health and Welfare (AIHW) 2015. Australian Cancer Incidence and Mortality (ACIM) Books: Lung cancer. Canberra: AIHW. Available at: http://www.aihw.gov.au/acim-books	0.46 (men) and 0.30 (women)
The Philippines	Adriano V. Laudico, Victoria Medina, Maria Rica Mirasol-Lumague, Cynthia A. Mapua, Maria Theresa M. Redaniel, Francisco G. Valenzuela, Eero Pukkala. 2010 Philippines Cancer Facts and Estimates	0.04 (men) and 0.01 (women)
Singapore	Singapore Cancer Registry Annual Registry Report Trends in Cancer Incidence in Singapore 2009 - 2013. NRDO. Available at: https://www.nrdo.gov.sg/docs/librariesprovider3/Publications-Cancer/cancer-trends-report-2009-2013.pdf?sfvrsn=0&AspxAutoDetectCookieSupport=1	0.25 (men) and 0.12 (women)

DALYs per 1,000 person-years). A similar trend was evident in the Philippines and Singapore, where people aged 70-79 years presented the highest calculated burden of lung cancer (the Philippines: 4.7 DALYs per 1,000 person-years and

Singapore: 16.8 DALYs per 1,000 person-years) (Figures 1-3).

The high burden from lung cancers in each country was mainly due to mortality. Almost 98% of DALYs in Australia,

Table 4 DALY, YLL, and YLD calculated using a discount rate of 3%

Country	Total YLL, YLD, and DALY in Australia, the Philippines, and Singapore during 2015			Per 1,000 YLL, YLD, and DALY in Australia, the Philippines, and Singapore during 2015		
	YLL	YLD	DALY	YLL	YLD	DALY
Australia	Men: 52,071 Women: 37,709	Men: 1,087 Women: 828	Total: 91,695 Men: 53,158 Women: 38,537	Men: 4.6 Women: 3.3	Men: 0.1 Women: 0.1	Total: 4.0 Men: 4.7 Women: 3.4
The Philippines	Men: 25,918 Women: 10,768	Men: 1,347 Women: 551	Total: 38,584 Men: 27,265 Women: 11,320	Men: 0.5 Women: 0.2	Men: 0.02 Women: 0.01	Total: 0.4 Men: 0.5 Women: 0.2
Singapore	Men: 7,760 Women: 4,507	Men: 101 Women: 67	Total: 12,435 Men: 7,861 Women: 4,574	Men: 2.8 Women: 1.6	Men: 0.04 Women: 0.02	Total: 2.2 Men: 2.8 Women: 1.6

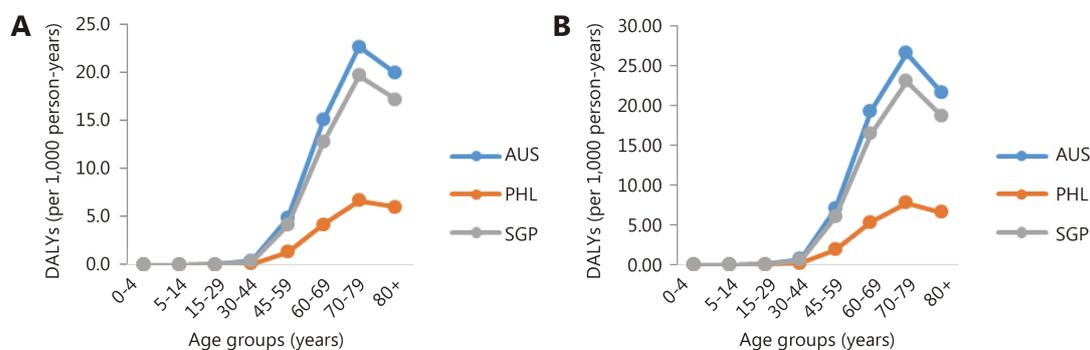


Figure 1 The age-specific rates of DALYs among men in Australia, the Philippines, and Singapore (2015) when a discount rate of 3% was used and when no discount rate was used. (A) Age-specific DALYs rate per 1,000 person-years among men in Australia, the Philippines and Singapore (using a discount rate of 3%). (B) Age-specific DALYs rate per 1,000 person-years among men in Australia, the Philippines and Singapore (without using a discount rate).

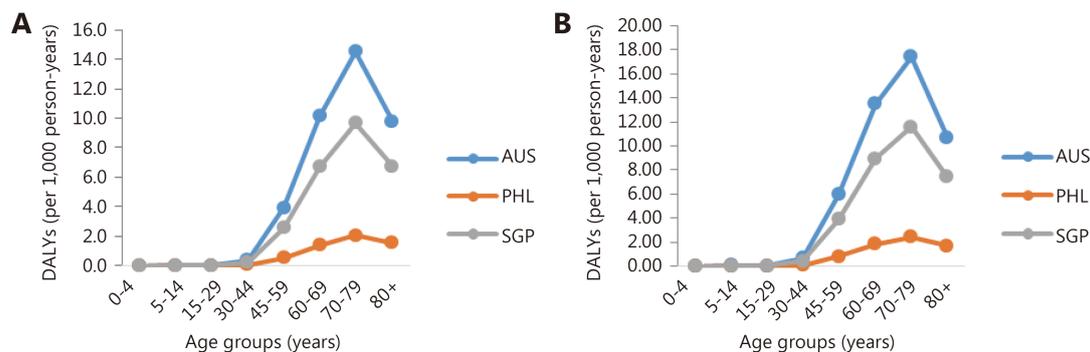


Figure 2 The age-specific rates of DALYs among women in Australia, the Philippines, and Singapore (2015) when a discount rate of 3% was used and when no discount rate was used. (A) Age-specific DALYs rate per 1,000 person-years among women in Australia, the Philippines and Singapore (using a discount rate of 3%). (B) Age-specific DALYs rate per 1,000 person-years among women in Australia, the Philippines and Singapore (without using a discount rate).

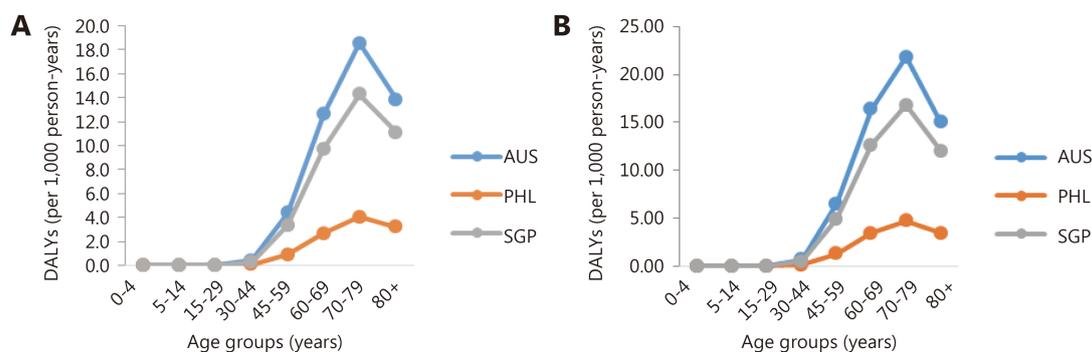


Figure 3 The age-specific rates of DALYs among men and women in Australia, the Philippines, and Singapore (2015) when a discount rate of 3% was used and when no discount rate was used. (A) Age-specific DALYs rate per 1,000 person-years among men and women in Australia, the Philippines and Singapore (using a discount rate of 3%). (B) Age-specific DALYs rate per 1,000 person-years among men and women in Australia, the Philippines and Singapore (without using a discount rate).

Table 5 DALY, YLL, and YLD calculated without using a discount rate

Country	Total YLL, YLD, and DALY in Australia, the Philippines, and Singapore during 2015			Per 1,000 YLL, YLD, and DALY in Australia, the Philippines, and Singapore during 2015		
	YLL	YLD	DALY	YLL	YLD	DALY
Australia	Men: 65,874 Women: 49,620	Men: 1,103 Women: 841	Total: 1,17,438 Men: 66,977 Women: 50,461	Men: 5.8 Women: 4.4	Men: 0.1 Women: 0.1	Total: 5.2 Men: 5.9 Women: 4.4
The Philippines	Men: 34,242 Women: 14,815	Men: 1,362 Women: 557	Total: 50,977 Men: 35,604 Women: 15,373	Men: 0.6 Women: 0.3	Men: 0.02 Women: 0.01	Total: 0.5 Men: 0.6 Women: 0.3
Singapore	Men: 10,097 Women: 6,113	Men: 102 Women: 67	Total: 16,379 Men: 10,199 Women: 6,180	Men: 3.6 Women: 2.1	Men: 0.04 Women: 0.02	Total: 2.9 Men: 3.7 Women: 2.1

96% in the Philippines, and 98% in Singapore were due to YLL.

Gender distribution showed that both YLL and YLD were higher in males than those in females. The contribution of males to YLL, YLD, and DALY ranged from 52%-57% in Australia, 70%-72% in the Philippines, and 60%-62% in Singapore, respectively.

An age-wise distribution of DALYs showed that people aged 60-69 years in all three countries contributed to the highest number of DALYs (Table S1 to Table S6 in the supplementary materials, available with the full text of this article at www.cancerbiomed.org). However, people aged 60-69 years contributed almost 31% of all DALYs in their respective countries, with the highest per-capita DALYs detected in people aged 70-79 years in the three countries.

Discussion

Researchers of studies on burden of disease cannot always precisely predict the true burden posed by a disease, considering that analyses that involve estimates are often

subject to errors. Different researchers may not arrive at the same conclusions because of their own distinctive and complex methods for estimating disease burden. Therefore, an intuitive and transparent methodology was adapted in the present study to present a comprehensible methodology for research peers. National level and country-specific estimates on lung cancer incidence, mortality, and survival were obtained to calculate the true burden of lung cancer in Australia, the Philippines, and Singapore.

Although the burden of disease studies no longer use discounts and age-weightage, DALYs were calculated with and without discount rates to compare findings with country-specific burden of disease studies. According to the Australian Institute of Health and Welfare (AIHW), lung cancer was predicted to be the leading cause of burden of disease due to cancer among men and the second highest burden of disease among women in Australia during 2012²¹. The total number of people diagnosed with lung cancer in Australia in 2012 was 11,280 cases, which include 6,620 males and 4,650 females²¹. During the same period, the estimated number of deaths from lung cancer were 8,410 cases, which

include 5,070 males and 3,340 females²¹.

The AIHW study showed that the burden of lung cancer in 2012 was 57,300 DALYs among men (19% of the total cancer burden) and 43,400 DALYs among women (17% of the total cancer burden among women), with a discount rate of 3%²¹. The present study showed that the burden of lung cancer was 53,158 DALYs in men and 38,537 DALYs in women, with a discount rate of 3%. Although the DALYs calculated by the research team are lower than the AIHW results, the differences are minimal and can be attributed to the use of the Australian specific life expectancy tables and disability weights and not to the WHO standards²². In addition, the AIHW study used population estimates from the Australian Bureau of Statistics, whereas the present research group used census data from the International Database of the United States Census Bureau. Furthermore, the differences in estimates may be due to regression analysis of the historical incidence and mortality data²².

When the DALYs were calculated without discount rates, the results considerably differed from the AIHW estimates, with the burden of lung cancer increasing to 66,977 DALYs in men and 50,461 DALYs in women in 2015. Although a difference in the DALY estimates was expected by the researcher group when no discount rate was used, the difference was remarkable. The causes of this difference remain unclear but could be partially attributed to the use of different population estimates and increasing trend of lung cancer incidence. Hence, the results implicate a significant disability caused by lung cancer among Australians.

Similarly, in Singapore and the Philippines, lung cancer is the commonly diagnosed and one of the leading causes of mortality among cancers in the ASEAN region. Singapore presents high age standardized (ASR) mortality due to lung cancer in this region, whereas the Philippines has a low age-standardized mortality rate among males and females combined^{6,23}. According to the Singapore burden of diseases study (SBoD), cardiovascular diseases and cancers accounted for 40% of the total DALYs in 2010, of which 80% was due to mortality²³. In Singapore, lung cancer contributed to 3.4% or 13,589 of the total DALYs (total DALY 399,675) in 2010²³. The findings from this study, which was conducted using a methodology similar to that used in the SBoD study, showed that lung cancer burden in Singapore was 12,435 DALYs. Moreover, the SBoD study showed that lung cancer accounted for 4.4% (9,252) and 2.4% (4,546) of the total 210,267 DALYs among males and 189,408 DALYs among females, respectively²³. The present study found these values to be 7,861 and 4,574 DALYs among males and females, respectively. The difference in DALYs between the SBoD study in 2010 and those calculated by the researchers with a

discount rate of 3% could be due to the use of Singapore-specific standard life expectancy tables in the SBoD study with increasing burden of lung cancer in Singapore²⁴. Although no other studies have evaluated the burden of lung cancer in Singapore without using a discount rate, the present study found the burden to be 16,379 DALYs.

In the Philippines, as per a previous study that estimated lung cancer burden without using a discount rate, the estimated DALYs were 104,442 in 2008²⁵. However, the value was found to be 50,977 DALYs in this study, which is less than half of the DALYs reported in a 2008 Philippines study. Although both studies were conducted using the same methodology, the differences in DALYs can be attributed to the use of DISMOD II for assessment of disease epidemiology rather than obtaining estimates from the CI5plus database as well as to the assumptions and projections made by the authors. When a discount rate of 3% was used, the DALYs decreased further to 38,584 in 2015. The Philippines is the only country that showed significant differences in DALYs among the three countries of interest. Furthermore, the majority of DALYs in these countries were caused by mortality. This finding is consistent with the findings from previous studies, where 99% of DALYs was due to YLL in the Philippines and 93% of DALYs were due to YLL in Singapore^{23,25}. The high incidence and mortality rates and poor survival rates for lung cancer among older individuals can be attributed to the strong effect of YLLs among DALYs in these countries.

Furthermore, the incidence, prevalence and mortality estimates made by the researchers are approximately similar to the projections made by GLOBOCAN^{26,27}. Notwithstanding the positives that arise out of this study, limitations were also present. Although the estimated DALYs are believed to reflect the actual lung cancer burden in these countries, the burden may considerably vary if varying prevalence of causal agents or other risk factors are considered when estimating DALYs.

Conclusions

Despite the major achievements in the field of oncology, the prognosis for lung cancer remains extremely poor and has only improved marginally over the decades. Data from the past three decades in Australia show that the 5-year survival rates marginally increased between 1982 and 2010. The 5-year survival was 8% for males and 10% for females during 1982-1987 and 13% for males and 17% for females during 2006-2010. At the same time, morbidity due to lung cancer has increased over the years. The number of hospitalizations

for lung cancer in Australia increased by 29% between 2000-2001 and 2008-2009^{14,18,21}. This trend is not limited to just Australia but is widely evident worldwide^{6,19,25,28}.

Considering the high mortality rates caused by lung cancer worldwide, appropriate strategies must be developed to manage the disease. Cancer burden can be controlled and reduced by identifying and developing strategies that focus on prevention, early diagnosis, and treatment. Initiatives such as the WHO Framework Convention on Tobacco Control can significantly reduce economic loss due to lung cancer²⁹. Tobacco, alcohol, obesity, unhealthy diet, physical inactivity, pollution, radiation, and infections are considered the main cancer risk factors worldwide³⁰. Given that smoking tobacco is one of the leading risk factors accounting for almost 70% of lung cancer deaths globally, the main focus should be on preventive strategies that reduce smoking. Studies have shown that interventions reduce the prevalence of smoking and have proven to be cost-effective. Although numerous countries have already formulated and enforced regulations to restrict tobacco usage, most health care systems have failed in giving priority to smoking interventions⁶.

In the Philippines, the Lung Cancer Control Program utilizes primary and tertiary prevention at special medical centers and rehabilitation activities to control smoking. Awareness messages have been spread through collaboration with Department of Education, Culture, and Sports and Bureau of Secondary Education in schools³¹. Regulations such as labeling and advertising on cigarette packs are being encouraged. Smoking is prohibited in workplaces, schools, gyms, parks, hospitals, elevators, and stairwells of all buildings, buses and bus depots, restaurants, and government facilities^{3,31}. Singapore implemented the legislation of smoke-free public places in 1970 and was the first Asian country to ban tobacco advertisements in 1971. Warnings for smokers have also been implemented. As a result, the country has one of the lowest smoking rates worldwide³². Currently, Singapore is implementing the point of sale display ban to reduce exposure of non-smokers to smoke. Moreover, the National Cancer Center of Singapore currently treats 60%-70% of all subsidized patients and 50% of all cancer patients in the country²⁸. The Cancer Council Australia develops cancer control policy resources, including prevention, early detection, clinical practice (treatment), and supportive care. Regulations such as reducing the affordability of tobacco products, strengthening mass media campaigns, eliminating advertising and promotion, and promoting smoke free zones are being encouraged³³. To add to its many initiatives, Australia became the first nation to implement the plain

packaging of tobacco products in 2012. Since the implementation of the plain packaging act, tobacco consumption decreased by 2.9% in a quarter and 12.2% over the year, at 2 years after the inception of the legislation³⁴.

All these attempts at improving lung cancer management are substantial. However, more collaborative efforts encompassing all aspects of chronic disease management are needed. These efforts include advocacy, providing information for policy, health promotion, surveillance, prevention, and management. Additional information is presented in **Tables S1 to S18** in the supplementary document.

Conflict of interest statement

No potential conflicts of interest are disclosed.

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Estimation of lung cancer burden in Australia the Philippines and Singapore: an evaluation of disability adjusted life years

Supplementary:

Table S1 DALY calculation for Australia using a discount rate of 3%

Age-group	Australia YLL+YLD								
	Men			Women			Total		
	Population	DALYs	DALYs per 1,000	Population	DALYs	DALYs per 1,000	Population	DALYs	DALYs per 1,000
0–4	701,411	0	0.0	6,65,426	1	0.0	13,66,837	1	0.0
5–14	1,388,150	0	0.0	13,17,293	28	0.0	27,05,443	28	0.0
15–29	2,360,690	27	0.0	22,50,848	27	0.0	46,11,538	54	0.0
30–44	2,459,914	1,029	0.4	23,59,601	871	0.4	48,19,515	1,900	0.4
45–59	2,240,388	10,850	4.8	22,13,178	8,729	3.9	44,53,566	19,579	4.4
60–69	1,200,342	18,158	15.1	12,29,752	12,508	10.2	24,30,094	30,667	12.6
70–79	692,837	15,813	22.8	7,46,984	10,864	14.5	14,39,821	26,678	18.5
80+	363,470	7,280	20.0	5,60,730	5,509	9.8	9,24,200	12,789	13.8
Total	11,407,202	53,158	4.7	113,43,812	38,537	3.4	227,51,014	91,695	4.0

Table S2 DALY calculation for Australia without using a discount rate

Age-group	Australia YLL+YLD								
	Men			Women			Total		
	Population	DALYs	DALYs per 1,000	Population	DALYs	DALYs per 1,000	Population	DALYs	DALYs per 1,000
0–4	701,411	0	0.0	6,65,426	1	0.0	13,66,837	1	0.0
5–14	1,388,150	0	0.0	13,17,293	71	0.1	27,05,443	71	0.0
15–29	2,360,690	52	0.0	22,50,848	54	0.0	46,11,538	106	0.0
30–44	2,459,914	1,771	0.7	23,59,601	1,540	0.7	48,19,515	3,310	0.7
45–59	2,240,388	15,735	7.0	22,13,178	13,179	6.0	44,53,566	28,913	6.5
60–69	1,200,342	23,146	19.3	12,29,752	16,598	13.5	24,30,094	39,744	16.4
70–79	692,837	18,411	26.6	7,46,984	13,009	17.4	14,39,821	31,421	21.8
80+	363,470	7,862	21.6	5,60,730	6,010	10.7	9,24,200	13,872	15.0
Total	11,407,202	66,977	5.9	113,43,812	50,461	4.4	227,51,014	1,17,438	5.2

Table S3 DALY calculation for Philippines using a discount rate of 3%

Age-group	Philippines (YLL+YLD)								
	Men			Women			Total		
	Population	DALYs	DALYs per 1,000	Population	DALYs	DALYs per 1,000	Population	DALYs	DALYs per 1,000
0–4	6,484,278	9	0.0	62,10,439	0	0.0	126,94,717	9	0.0
5–14	12,156,201	0	0.0	116,81,553	34	0.0	238,37,754	34	0.0
15–29	15,249,940	49	0.0	147,09,474	31	0.0	299,59,414	80	0.0
30–44	11,124,050	1,241	0.1	108,08,803	546	0.1	219,32,853	1,786	0.1
45–59	6,404,466	8,261	1.3	68,39,109	3,593	0.5	132,43,575	11,854	0.9
60–69	2,209,635	9,298	4.2	26,42,944	3,656	1.4	48,52,579	12,955	2.7
70–79	994,953	6,663	6.7	13,16,304	2,692	2.0	23,11,257	9,355	4.0
80+	288,046	1,744	6.1	4,95,718	767	1.5	7,83,764	2,511	3.2
Total	54,911,569	27,265	0.5	547,04,344	11,320	0.2	1096,15,913	38,584	0.4

Table S4 DALY calculation for Philippines without using a discount rate

Age-group	Philippines (YLL+YLD)								
	Men			Women			Total		
	Population	DALYs	DALYs per 1,000	Population	DALYs	DALYs per 1,000	Population	DALYs	DALYs per 1,000
0–4	6,484,278	9	0.0	62,10,439	0	0.0	126,94,717	9	0.0
5–14	12,156,201	0	0.0	116,81,553	87	0.0	238,37,754	87	0.0
15–29	15,249,940	89	0.0	147,09,474	52	0.0	299,59,414	141	0.0
30–44	11,124,050	2,110	0.2	108,08,803	929	0.1	219,32,853	3,039	0.1
45–5	6,404,466	11,955	1.9	68,39,109	5,409	0.8	132,43,575	17,364	1.3
60–69	2,209,635	11,836	5.4	26,42,944	4,846	1.8	48,52,579	16,682	3.4
70–79	994,953	7,716	7.8	13,16,304	3,211	2.4	23,11,257	10,927	4.7
80+	288,046	1,888	6.6	4,95,718	840	1.7	7,83,764	2,728	3.5
Total	54,911,569	35,604	0.6	547,04,344	15,373	0.3	1096,15,913	50,977	0.5

Table S5 DALY calculation for Singapore using a discount rate of 3%

Age-group	Singapore (YLL+YLD)								
	Men			Women			Total		
	Population	DALYs	DALYs per 1,000	Population	DALYs	DALYs per 1,000	Population	DALYs	DALYs per 1,000
0–4	117,743	0.00	0.00	1,11,042	0.00	0.00	2,28,785	0.00	0.00
5–14	263,661	0.13	0.00	2,53,382	3.26	0.01	5,17,043	3.38	0.01
15–29	786,793	9.58	0.01	8,25,644	7.48	0.01	16,12,437	17.06	0.01
30–44	720,269	243.32	0.34	7,69,021	173.34	0.23	14,89,290	416.66	0.28
45–59	535,053	2,208.46	4.13	5,32,616	1,362.74	2.56	10,67,669	3,571.21	3.34
60–69	220,393	2,827.40	12.83	2,27,854	1,527.88	6.71	4,48,247	4,355.28	9.72
70–79	88,731	1,758.19	19.81	1,07,134	1,038.38	9.69	1,95,865	2,796.57	14.28
80+	47,032	814.00	17.31	68,104	460.74	6.77	1,15,136	1,274.73	11.07
Total	2,779,675	7,861	2.8	28,94,797	4,574	1.6	56,74,472	12,435	2.2

Table S6 DALY calculation for Singapore without using a discount rate

Age-group	Singapore (YLL+YLD)								
	Men			Women			Total		
	Population	DALYs	DALYs per 1,000	Population	DALYs	DALYs per 1,000	Population	DALYs	DALYs per 1,000
0-4	117,743	0.00	0.00	1,11,042	0.00	0.00	2,28,785	0.00	0.00
5-14	263,661	0.13	0.00	2,53,382	8.20	0.03	5,17,043	8.33	0.02
15-29	786,793	17.52	0.02	8,25,644	14.77	0.02	16,12,437	32.30	0.02
30-44	720,269	422.35	0.59	7,69,021	308.73	0.40	14,89,290	731.08	0.49
45-59	535,053	3,213.41	6.01	5,32,616	2,067.60	3.88	10,67,669	5,281.00	4.95
60-69	220,393	3,619.54	16.42	2,27,854	2,034.10	8.93	4,48,247	5,653.64	12.61
70-79	88,731	2,046.39	23.06	1,07,134	1,243.13	11.60	1,95,865	3,289.52	16.79
80+	47,032	879.23	18.69	68,104	503.86	7.40	1,15,136	1,383.09	12.01
Total	2,779,675	10,199	3.7	28,94,797	6,180	2.1	56,74,472	16,379	2.9

Table S7 Calculation of YLL in Australia using a discount rate of 3%

	Population	Deaths	Deaths per 1,000	Av. age at death	Standard LE	YLLs	YLL per 1,000
Men							
0-4	7,01,411	0	0.00	2.6	79.9	1,000 0	0.0
5-9	6,99,046	0	0.00	7.3	73.1	1,000 0	0.0
10-14	6,89,104	0	0.00	12.9	67.5	1,000 0	0.0
15-19	7,23,770	0	0.00	18.1	62.4	1,000 0	0.0
20-24	8,09,756	0	0.00	22.5	57.9	1,000 0	0.0
25-29	8,27,164	1	0.00	27.5	53.0	1,000 25	0.0
30-34	8,26,633	5	0.01	32.6	48.0	1,000 126	0.2
35-39	8,08,319	10	0.01	37.5	43.1	1,000 253	0.3
40-44	8,24,962	28	0.03	42.6	38.1	1,000 637	0.8
45-49	7,86,482	74	0.09	47.7	33.2	1,000 1,548	2.0
50-54	7,48,523	178	0.24	52.6	28.5	1,000 3,413	4.6
55-59	7,05,383	338	0.48	57.6	23.9	1,000 5,776	8.2
60-64	6,28,541	515	0.82	62.7	19.5	1,000 7,613	12.1
65-69	5,71,801	828	1.45	67.7	15.4	1,000 10,211	17.9
70-74	4,06,958	918	2.26	72.6	11.8	1,000 9,145	22.5
75-79	2,85,879	814	2.85	77.5	8.8	1,000 6,317	22.1
80-84	1,86,867	709	3.80	82.4	6.4	1,000 4,115	22.0
85+	1,76,603	790	4.47	89.0	3.9	1,000 2,894	16.4
Total	114,07,202	5,209	0.46	73.1	12.6	52,071	4.6

Continued

Continued

	Population	Deaths	Deaths per 1,000	Av. age at death	Standard LE		YLLs	YLL per 1,000
Women								
0–4	665,426	0	0.00	2.6	82.4	1.000	0	0.0
5–9	663,465	1	0.00	7.4	75.6	1.000	28	0.0
10–14	653,828	0	0.00	12.6	70.4	1.000	0	0.0
15–19	685,863	0	0.00	17.9	65.2	1.000	0	0.0
20–24	770,007	0	0.00	22.6	60.5	1.000	0	0.0
25–29	794,978	1	0.00	27.5	55.7	1.000	25	0.0
30–34	792,254	4	0.00	32.6	50.7	1.000	100	0.1
35–39	772,862	7	0.01	37.5	45.9	1.000	173	0.2
40–44	794,485	25	0.03	42.7	41.0	1.000	581	0.7
45–49	766,048	60	0.08	47.7	36.2	1.000	1,314	1.7
50–54	737,744	152	0.21	52.6	31.6	1.000	3,101	4.2
55–59	709,386	226	0.32	57.7	26.9	1.000	4,174	5.9
60–64	645,961	334	0.52	62.6	22.5	1.000	5,469	8.5
65–69	583,791	487	0.83	67.6	18.2	1.000	6,824	11.7
70–74	425,265	532	1.25	72.6	14.1	1.000	6,124	14.4
75–79	321,719	499	1.55	77.6	10.5	1.000	4,512	14.0
80–84	242,637	436	1.80	82.6	7.5	1.000	2,939	12.1
85+	318,093	587	1.85	90.0	4.3	1.000	2,344	7.4
Total	11,343,812	3,349	0.30	73.3	14.8		37,709	3.3
Men								
0–4	701,411	0	0.0				0	0.0
5–14	1,388,150	0	0.0				0	0.0
15–29	2,360,690	1	0.0	27.5			25	0.0
30–44	2,459,914	43	0.0	40.2			1,016	0.4
45–59	2,240,388	590	0.3	54.9			10,736	4.8
60–69	1,200,342	1,344	1.1	65.8			17,823	14.8
70–79	692,837	1,732	2.5	74.9			15,462	22.3
80+	363,470	1,499	4.1	85.9			7,009	19.3
Total	11,407,202	5,209	0.5	73.1			52,071	4.6
Women								
0–4	665,426	0	0.0				0	0.0
5–14	1,317,293	1	0.0	7.4			28	0.0
15–29	2,250,848	1	0.0	27.5			25	0.0
30–44	2,359,601	35	0.0	40.6			854	0.4
45–59	2,213,178	437	0.2	54.6			8,589	3.9
60–69	1,229,752	820	0.7	65.6			12,293	10.0
70–79	746,984	1,031	1.4	75.0			10,637	14.2
80+	560,730	1,023	1.8	86.8			5,283	9.4
Total	11,343,812	3,349	0.3	73.3			37,709	3.3

Table S8 Calculation of YLD in Australia using a discount rate of 3%

	Population	Incident cases	Incidence per 1,000	Age at onset	Duration (years)	Disability Weights	YLDs	YLD per 1,000
Men								
0–4	701,411	1	0.0	2.5	1.01	0.146	0	0.0
5–14	1,388,150	0	0.0	10.0	1.01	0.146	0	0.0
15–29	2,360,690	14	0.0	22.5	1.01	0.146	2	0.0
30–44	2,459,914	91	0.0	37.5	1.01	0.146	13	0.0
45–59	2,240,388	782	0.3	52.5	1.01	0.146	114	0.1
60–69	1,200,342	2,306	1.9	65.0	1.01	0.146	335	0.3
70–79	692,837	2,418	3.5	75.0	1.01	0.146	351	0.5
80+	363,470	1,867	5.1	85.0	1.01	0.146	271	0.7
Total	11,407,202	7,479	0.7	71.5	1.0	0.146	1,087	0.1
Women								
0–4	665,426	4	0.0	2.5	1.01	0.146	1	0.0
5–14	1,317,293	1	0.0	10.0	1.01	0.146	0	0.0
15–29	2,250,848	11	0.0	22.5	1.01	0.146	2	0.0
30–44	2,359,601	116	0.0	37.5	1.01	0.146	17	0.0
45–59	2,213,178	962	0.4	52.5	1.01	0.146	140	0.1
60–69	1,229,752	1,482	1.2	65.0	1.01	0.146	215	0.2
70–79	746,984	1,567	2.1	75.0	1.01	0.146	228	0.3
80+	560,730	1,556	2.8	85.0	1.01	0.146	226	0.4
Total	11,343,812	5,699	0.5	70.4	1.0	0.146	828	0.1

Table S9 Calculation of YLL in Singapore using a discount rate of 3%

	Population	Deaths	Deaths per 1,000	Av. age at death	Standard LE	YLLs	YLL per 1,000
Men							
0–4	117,743	0	0.00	2.6	79.9	1.000	0
5–9	118,856	0	0.00	7.3	73.1	1.000	0
10–14	144,805	0	0.00	12.9	67.5	1.000	0
15–19	204,350	0	0.00	18.1	62.4	1.000	0
20–24	282,629	0	0.00	22.5	57.9	1.000	0
25–29	299,814	0	0.00	27.5	53.0	1.000	8
30–34	276,507	1	0.01	32.6	48.0	1.000	37
35–39	230,434	3	0.01	37.5	43.1	1.000	63
40–44	213,328	6	0.03	42.6	38.1	1.000	144
45–49	193,168	16	0.08	47.7	33.2	1.000	331
50–54	180,435	37	0.21	52.6	28.5	1.000	717
55–59	161,450	67	0.42	57.6	23.9	1.000	1,152
60–64	127,039	91	0.71	62.7	19.5	1.000	1,341
65–69	93,354	118	1.26	67.7	15.4	1.000	1,453
70–74	50,588	99	1.97	72.6	11.8	1.000	991
75–79	38,143	95	2.48	77.5	8.8	1.000	735
80–84	23,995	79	3.31	82.4	6.4	1.000	460
85+	23,037	90	3.90	89.0	3.9	1.000	329
Total	2,779,675	703	0.25	70.8	14.4		7,760

Continued

Continued

	Population	Deaths	Deaths per 1,000	Av. age at death	Standard LE		YLLs	YLL per 1,000
Women								
0-4	111,042	0	0.00	2.6	82.4	1.000	0	0.0
5-9	114,132	0	0.00	7.4	75.6	1.000	3	0.0
10-14	139,250	0	0.00	12.6	70.4	1.000	0	0.0
15-19	198,762	0	0.00	17.9	65.2	1.000	0	0.0
20-24	303,397	0	0.00	22.6	60.5	1.000	0	0.0
25-29	323,485	0	0.00	27.5	55.7	1.000	7	0.0
30-34	306,020	1	0.00	32.6	50.7	1.000	26	0.1
35-39	240,710	1	0.01	37.5	45.9	1.000	36	0.2
40-44	222,291	5	0.02	42.7	41.0	1.000	109	0.5
45-49	196,861	10	0.05	47.7	36.2	1.000	227	1.2
50-54	176,234	24	0.14	52.6	31.6	1.000	497	2.8
55-59	159,521	34	0.21	57.7	26.9	1.000	629	3.9
60-64	128,471	45	0.35	62.6	22.5	1.000	729	5.7
65-69	99,383	56	0.56	67.6	18.2	1.000	779	7.8
70-74	58,762	49	0.84	72.6	14.1	1.000	567	9.7
75-79	48,372	50	1.04	77.6	10.5	1.000	455	9.4
80-84	33,308	40	1.20	82.6	7.5	1.000	271	8.1
85+	34,796	43	1.24	90.0	4.3	1.000	172	4.9
Total	2,894,797	359	0.12	70.3	17.0		4,507	1.6
Men								
0-4	117,743	0	0.0				0	0.0
5-14	263,661	0	0.0				0	0.0
15-29	786,793	0	0.0		27.5		8	0.0
30-44	720,269	10	0.0		39.9		243	0.3
45-59	535,053	121	0.2		54.8		2,201	4.1
60-69	220,393	209	0.9		65.5		2,794	12.7
70-79	88,731	194	2.2		74.9		1,725	19.4
80+	47,032	169	3.6		85.9		790	16.8
Total	2,779,675	703	0.3		70.8		7,760	2.8
Women								
0-4	111,042	0	0.0				0	0.0
5-14	253,382	0	0.0		7.4		3	0.0
15-29	825,644	0	0.0		27.5		7	0.0
30-44	769,021	7	0.0		40.2		171	0.2
45-59	532,616	69	0.1		54.4		1,353	2.5
60-69	227,854	100	0.4		65.4		1,508	6.6
70-79	107,134	100	0.9		75.1		1,022	9.5
80+	68,104	83	1.2		86.4		443	6.5
Total	2,894,797	359	0.1		70.3		4,507	1.6

Table S10 Calculation of YLD in Singapore using a Discount Rate of 3%

	Population	Incident cases	Incidence per 1,000	Age at onset	Duration (years)	Disability Weight	YLDs	YLD per 1,000
Men								
0-4	117,743	0	0.0	2.5	0.7	0.146	0	0.0
5-14	263,661	1	0.0	10.0	0.7	0.146	0	0.0
15-29	786,793	15	0.0	22.5	0.7	0.146	2	0.0
30-44	720,269	2	0.0	37.5	0.7	0.146	0	0.0
45-59	535,053	74	0.1	52.5	0.7	0.146	8	0.0
60-69	220,393	312	1.4	65.0	0.7	0.146	33	0.2
70-79	88,731	306	3.4	75.0	0.7	0.146	33	0.4
80+	47,032	228	4.9	85.0	0.7	0.146	24	0.5
Total	2,779,675	939	0.3	71.3	0.7	0.146	101	0.04
Women								
0-4	111,042	0	0.0	2.5	0.7	0.146	0	0.0
5-14	253,382	0	0.0	10.0	0.7	0.146	0	0.0
15-29	825,644	6	0.0	22.5	0.7	0.146	1	0.0
30-44	769,021	21	0.0	37.5	0.7	0.146	2	0.0
45-59	532,616	94	0.2	52.5	0.7	0.146	10	0.0
60-69	227,854	182	0.8	65.0	0.7	0.146	19	0.1
70-79	107,134	149	1.4	75.0	0.7	0.146	16	0.1
80+	68,104	170	2.5	85.0	0.7	0.146	18	0.3
Total	2,894,797	622	0.2	69.6	0.7	0.146	67	0.02

Table S11 Calculation of YLL in Philippines using a discount rate of 3%

	Population	Deaths	Deaths per 1,000	Av. Age at death	Standard LE	YLLs	YLL per 1,000
Men							
0-4	6,484,278	0	0.00	2.6	79.9	1.000	0
5-9	6,230,989	0	0.00	7.3	73.1	1.000	0
10-14	5,925,212	0	0.00	12.9	67.5	1.000	0
15-19	5,532,556	0	0.00	18.1	62.4	1.000	0
20-24	5,038,813	0	0.00	22.5	57.9	1.000	0
25-29	4,678,571	1	0.00	27.5	53.0	1.000	40
30-34	4,286,702	7	0.00	32.6	48.0	1.000	182
35-39	3,732,328	13	0.00	37.5	43.1	1.000	325
40-44	3,105,020	29	0.01	42.6	38.1	1.000	668
45-49	2,585,574	67	0.03	47.7	33.2	1.000	1,418
50-54	2,126,761	141	0.07	52.6	28.5	1.000	2,702
55-59	1,692,131	226	0.13	57.6	23.9	1.000	3,861
60-64	1,301,684	297	0.23	62.7	19.5	1.000	4,393
65-69	907,951	366	0.40	67.7	15.4	1.000	4,518
70-74	616,360	388	0.63	72.6	11.8	1.000	3,859
75-79	378,593	300	0.79	77.5	8.8	1.000	2,331
80-84	195,091	206	1.06	82.4	6.4	1.000	1,197
85+	92,955	116	1.25	89.0	3.9	1.000	424
Total	54,911,569	2,160	0.04	68.4	15.9		25,918

Continued

Continued

	Population	Deaths	Deaths per 1,000	Av. Age at death	Standard LE		YLLs	YLL per 1,000
Women								
0–4	6,210,439	0	0.00	2.6	82.4	1.000	0	0.0
5–9	5,982,874	1	0.00	7.4	75.6	1.000	34	0.0
10–14	5,698,679	0	0.00	12.6	70.4	1.000	0	0.0
15–19	5,328,823	0	0.00	17.9	65.2	1.000	0	0.0
20–24	4,862,680	0	0.00	22.6	60.5	1.000	0	0.0
25–29	4,517,971	1	0.00	27.5	55.7	1.000	19	0.0
30–34	4,144,840	3	0.00	32.6	50.7	1.000	71	0.0
35–39	3,635,615	4	0.00	37.5	45.9	1.000	111	0.0
40–44	3,028,348	13	0.00	42.7	41.0	1.000	301	0.1
45–49	2,622,893	28	0.01	47.7	36.2	1.000	612	0.2
50–54	2,278,266	64	0.03	52.6	31.6	1.000	1,302	0.6
55–59	1,937,950	84	0.04	57.7	26.9	1.000	1,551	0.8
60–64	1,559,774	110	0.07	62.6	22.5	1.000	1,796	1.2
65–69	1,083,170	123	0.11	67.6	18.2	1.000	1,722	1.6
70–74	781,401	133	0.17	72.6	14.1	1.000	1,531	2.0
75–79	534,903	113	0.21	77.6	10.5	1.000	1,020	1.9
80–84	309,166	76	0.24	82.6	7.5	1.000	509	1.6
85+	186,552	47	0.25	90.0	4.3	1.000	187	1.0
Total	54,704,344	798	0.01	68.2	18.6		10,768	0.2

	Population	Deaths	Deaths per 1,000	Av. age at death	YLLs	YLL per 1,000
Men						
0–4	6,484,278	0	0.0		0	0.0
5–14	12,156,201	0	0.0		0	0.0
15–29	15,249,940	1	0.0	27.5	40	0.0
30–44	11,124,050	50	0.0	39.8	1,175	0.1
45–59	6,404,466	434	0.1	54.5	7,980	1.2
60–69	2,209,635	664	0.3	65.4	8,911	4.0
70–79	994,953	688	0.7	74.7	6,190	6.2
80+	288,046	322	1.1	84.8	1,621	5.6
Total	54,911,569	2,160	0.0	68.4	25,918	0.5
Women						
0–4	6,210,439	0	0.0		0	0.0
5–14	11,681,553	1	0.0	7.4	34	0.0
15–29	14,709,474	1	0.0	27.5	19	0.0
30–44	10,808,803	20	0.0	40.1	483	0.0
45–59	6,839,109	176	0.0	54.3	3,466	0.5
60–69	2,642,944	232	0.1	65.3	3,518	1.3
70–79	1,316,304	246	0.2	74.9	2,551	1.9
80+	495,718	122	0.2	85.4	696	1.4
Total	54,704,344	798	0.0	68.2	10,768	0.2

Table S12 Calculation of YLD in Philippines using a discount rate of 3%

	Population	Incident cases	Incidence per 1,000	Age at onset	Duration (years)	Disability Weight	YLDs	YLD per 1,000
Men								
0-4	6,484,278	88	0.0	2.5	0.7	0.146	9	0.0
5-14	12,156,201	0	0.0	10.0	0.7	0.146	0	0.0
15-29	15,249,940	90	0.0	22.5	0.7	0.146	10	0.0
30-44	11,124,050	616	0.1	37.5	0.7	0.146	65	0.0
45-59	6,404,466	2,651	0.4	52.5	0.7	0.146	281	0.0
60-69	2,209,635	3,663	1.7	65.0	0.7	0.146	388	0.2
70-79	994,953	4,463	4.5	75.0	0.7	0.146	472	0.5
80+	288,046	1,154	4.0	85.0	0.7	0.146	122	0.4
Total	54,911,569	12,724	0.2	65.7	0.7	0.146	1,347	0.02
Women								
0-4	6,210,439	0	0.0	2.5	0.7	0.146	0	0.0
5-14	11,681,553	0	0.0	10.0	0.7	0.146	0	0.0
15-29	14,709,474	109	0.0	22.5	0.7	0.146	12	0.0
30-44	10,808,803	590	0.1	37.5	0.7	0.146	62	0.0
45-59	6,839,109	1,205	0.2	52.5	0.7	0.146	128	0.0
60-69	2,642,944	1,305	0.5	65.0	0.7	0.146	138	0.1
70-79	1,316,304	1,331	1.0	75.0	0.7	0.146	141	0.1
80+	495,718	670	1.4	85.0	0.7	0.146	71	0.1
Total	54,704,344	5,209	0.1	63.2	0.7	0.146	551	0.01

Table S13 Calculation of YLL in Australia without using a discount rate

	Population	Deaths	Deaths per 1,000	Av. age at death	Standard LE	YLLs	YLL per 1,000
Men							
0-4	7,01,411	0	0.00	2.6	79.9	1.000	0
5-9	6,99,046	0	0.00	7.3	73.1	1.000	0
10-14	6,89,104	0	0.00	12.9	67.5	1.000	0
15-19	7,23,770	0	0.00	18.1	62.4	1.000	0
20-24	8,09,756	0	0.00	22.5	57.9	1.000	0
25-29	8,27,164	1	0.00	27.5	53.0	1.000	50
30-34	8,26,633	5	0.01	32.6	48.0	1.000	238
35-39	8,08,319	10	0.01	37.5	43.1	1.000	450
40-44	8,24,962	28	0.03	42.6	38.1	1.000	1,069
45-49	7,86,482	74	0.09	47.7	33.2	1.000	2,444
50-54	7,48,523	178	0.24	52.6	28.5	1.000	5,078
55-59	7,05,383	338	0.48	57.6	23.9	1.000	8,096
60-64	6,28,541	515	0.82	62.7	19.5	1.000	10,056
65-69	5,71,801	828	1.45	67.7	15.4	1.000	12,750
70-74	4,06,958	918	2.26	72.6	11.8	1.000	10,864
75-79	2,85,879	814	2.85	77.5	8.8	1.000	7,191
80-84	1,86,867	709	3.80	82.4	6.4	1.000	4,520
85+	1,76,603	790	4.47	89.0	3.9	1.000	3,066
Total	114,07,202	5,209	0.46	73.1	12.6		65,874

Continued

Continued

	Population	Deaths	Deaths per 1,000	Av. age at death	Standard LE		YLLs	YLL per 1,000
Women								
0–4	665,426	0	0.00	2.6	82.4	1.000	0	0.0
5–9	663,465	1	0.00	7.4	75.6	1.000	71	0.1
10–14	653,828	0	0.00	12.6	70.4	1.000	0	0.0
15–19	685,863	0	0.00	17.9	65.2	1.000	0	0.0
20–24	770,007	0	0.00	22.6	60.5	1.000	0	0.0
25–29	794,978	1	0.00	27.5	55.7	1.000	52	0.1
30–34	792,254	4	0.00	32.6	50.7	1.000	195	0.2
35–39	772,862	7	0.01	37.5	45.9	1.000	319	0.4
40–44	794,485	25	0.03	42.7	41.0	1.000	1,009	1.3
45–49	766,048	60	0.08	47.7	36.2	1.000	2,154	2.8
50–54	737,744	152	0.21	52.6	31.6	1.000	4,800	6.5
55–59	709,386	226	0.32	57.7	26.9	1.000	6,082	8.6
60–64	645,961	334	0.52	62.6	22.5	1.000	7,523	11.6
65–69	583,791	487	0.83	67.6	18.2	1.000	8,856	15.2
70–74	425,265	532	1.25	72.6	14.1	1.000	7,515	17.7
75–79	321,719	499	1.55	77.6	10.5	1.000	5,263	16.4
80–84	242,637	436	1.80	82.6	7.5	1.000	3,283	13.5
85+	318,093	587	1.85	90.0	4.3	1.000	2,497	7.8
Total	11,343,812	3,349	0.30	73.3	14.8		49,620	4.4
Men								
0–4	701,411	0	0.0				0	0.0
5–14	1,388,150	0	0.0				0	0.0
15–29	2,360,690	1	0.0	27.5			50	0.0
30–44	2,459,914	43	0.0	40.2			1,757	0.7
45–59	2,240,388	590	0.3	54.9			15,619	7.0
60–69	1,200,342	1,344	1.1	65.8			22,806	19.0
70–79	692,837	1,732	2.5	74.9			18,055	26.1
80+	363,470	1,499	4.1	85.9			7,587	20.9
Total	11,407,202	5,209	0.5	73.1			65,874	5.8
Women								
0–4	665,426	0	0.0				0	0.0
5–14	1,317,293	1	0.0	7.4			71	0.1
15–29	2,250,848	1	0.0	27.5			52	0.0
30–44	2,359,601	35	0.0	40.6			1,523	0.6
45–59	2,213,178	437	0.2	54.6			13,037	5.9
60–69	1,229,752	820	0.7	65.6			16,379	13.3
70–79	746,984	1,031	1.4	75.0			12,778	17.1
80+	560,730	1,023	1.8	86.8			5,780	10.3
Total	11,343,812	3,349	0.3	73.3			49,620	4.4

Table S14 Calculation of YLD in Australia without using a discount rate

	Population	Incident cases	Incidence per 1,000	Age at onset	Duration (years)	Disability weights	YLDs	YLD per 1,000
Men								
0–4	701,411	1	0.0	2.5	1.01	0.146	0	0.0
5–14	1,388,150	0	0.0	10.0	1.01	0.146	0	0.0
15–29	2,360,690	14	0.0	22.5	1.01	0.146	2	0.0
30–44	2,459,914	91	0.0	37.5	1.01	0.146	13	0.0
45–59	2,240,388	782	0.3	52.5	1.01	0.146	115	0.1
60–69	1,200,342	2,306	1.9	65.0	1.01	0.146	340	0.3
70–79	692,837	2,418	3.5	75.0	1.01	0.146	357	0.5
80+	363,470	1,867	5.1	85.0	1.01	0.146	275	0.8
Total	11,407,202	7,479	0.7	71.5	1.0	0.146	1,103	0.1
Women								
0–4	665,426	4	0.0	2.5	1.01	0.146	1	0.0
5–14	1,317,293	1	0.0	10.0	1.01	0.146	0	0.0
15–29	2,250,848	11	0.0	22.5	1.01	0.146	2	0.0
30–44	2,359,601	116	0.0	37.5	1.01	0.146	17	0.0
45–59	2,213,178	962	0.4	52.5	1.01	0.146	142	0.1
60–69	1,229,752	1,482	1.2	65.0	1.01	0.146	219	0.2
70–79	746,984	1,567	2.1	75.0	1.01	0.146	231	0.3
80+	560,730	1,556	2.8	85.0	1.01	0.146	229	0.4
Total	11,343,812	5,699	0.5	70.4	1.0	0.146	841	0.1

Table S15 Calculation of YLL in Singapore without using a discount rate

	Population	Deaths	Deaths per 1,000	Av. age at death	Standard LE	YLLs	YLL per 1,000
Men							
0–4	117,743	0	0.00	2.6	79.9	1.000	0
5–9	118,856	0	0.00	7.3	73.1	1.000	0
10–14	144,805	0	0.00	12.9	67.5	1.000	0
15–19	204,350	0	0.00	18.1	62.4	1.000	0
20–24	282,629	0	0.00	22.5	57.9	1.000	0
25–29	299,814	0	0.00	27.5	53.0	1.000	16
30–34	276,507	1	0.01	32.6	48.0	1.000	69
35–39	230,434	3	0.01	37.5	43.1	1.000	112
40–44	213,328	6	0.03	42.6	38.1	1.000	241
45–49	193,168	16	0.08	47.7	33.2	1.000	523
50–54	180,435	37	0.21	52.6	28.5	1.000	1,067
55–59	161,450	67	0.42	57.6	23.9	1.000	1,615
60–64	127,039	91	0.71	62.7	19.5	1.000	1,771
65–69	93,354	118	1.26	67.7	15.4	1.000	1,814
70–74	50,588	99	1.97	72.6	11.8	1.000	1,177
75–79	38,143	95	2.48	77.5	8.8	1.000	836
80–84	23,995	79	3.31	82.4	6.4	1.000	506
85+	23,037	90	3.90	89.0	3.9	1.000	349
Total	2,779,675	703	0.25	70.8	14.4		10,097

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Continued

	Population	Deaths	Deaths per 1,000	Av. age at death	Standard LE		YLLs	YLL per 1,000
Women								
0–4	111,042	0	0.00	2.6	82.4	1.000	0	0.0
5–9	114,132	0	0.00	7.4	75.6	1.000	8	0.1
10–14	139,250	0	0.00	12.6	70.4	1.000	0	0.0
15–19	198,762	0	0.00	17.9	65.2	1.000	0	0.0
20–24	303,397	0	0.00	22.6	60.5	1.000	0	0.0
25–29	323,485	0	0.00	27.5	55.7	1.000	14	0.0
30–34	306,020	1	0.00	32.6	50.7	1.000	51	0.2
35–39	240,710	1	0.01	37.5	45.9	1.000	67	0.3
40–44	222,291	5	0.02	42.7	41.0	1.000	189	0.9
45–49	196,861	10	0.05	47.7	36.2	1.000	371	1.9
50–54	176,234	24	0.14	52.6	31.6	1.000	769	4.4
55–59	159,521	34	0.21	57.7	26.9	1.000	917	5.7
60–64	128,471	45	0.35	62.6	22.5	1.000	1,003	7.8
65–69	99,383	56	0.56	67.6	18.2	1.000	1,011	10.2
70–74	58,762	49	0.84	72.6	14.1	1.000	696	11.8
75–79	48,372	50	1.04	77.6	10.5	1.000	531	11.0
80–84	33,308	40	1.20	82.6	7.5	1.000	302	9.1
85+	34,796	43	1.24	90.0	4.3	1.000	183	5.3
Total	2,894,797	359	0.12	70.3	17.0		6,113	2.1
Men								
0–4	117,743	0	0.0				0	0.0
5–14	263,661	0	0.0				0	0.0
15–29	786,793	0	0.0		27.5		16	0.0
30–44	720,269	10	0.0		39.9		422	0.6
45–59	535,053	121	0.2		54.8		3,205	6.0
60–69	220,393	209	0.9		65.5		3,586	16.3
70–79	88,731	194	2.2		74.9		2,013	22.7
80+	47,032	169	3.6		85.9		854	18.2
Total	2,779,675	703	0.3		70.8		10,097	3.6
Women								
0–4	111,042	0	0.0				0	0.0
5–14	253,382	0	0.0		7.4		8	0.0
15–29	825,644	0	0.0		27.5		14	0.0
30–44	769,021	7	0.0		40.2		306	0.4
45–59	532,616	69	0.1		54.4		2,057	3.9
60–69	227,854	100	0.4		65.4		2,014	8.8
70–79	107,134	100	0.9		75.1		1,227	11.5
80+	68,104	83	1.2		86.4		485	7.1
Total	2,894,797	359	0.1		70.3		6,113	2.1

Table S16 Calculation of YLD in Singapore without using a discount rate

	Population	Incident cases	Incidence per 1,000	Age at onset	Duration (years)	Disability weight	YLDs	YLD per 1,000
Men								
0–4	117,743	0	0.0	2.5	0.7	0.146	0	0.0
5–14	263,661	1	0.0	10.0	0.7	0.146	0	0.0
15–29	786,793	15	0.0	22.5	0.7	0.146	2	0.0
30–44	720,269	2	0.0	37.5	0.7	0.146	0	0.0
45–59	535,053	74	0.1	52.5	0.7	0.146	8	0.0
60–69	220,393	312	1.4	65.0	0.7	0.146	34	0.2
70–79	88,731	306	3.4	75.0	0.7	0.146	33	0.4
80+	47,032	228	4.9	85.0	0.7	0.146	25	0.5
Total	2,779,675	939	0.3	71.3	0.7	0.146	102	0.04
Women								
0–4	111,042	0	0.0	2.5	0.7	0.146	0	0.0
5–14	253,382	0	0.0	10.0	0.7	0.146	0	0.0
15–29	825,644	6	0.0	22.5	0.7	0.146	1	0.0
30–44	769,021	21	0.0	37.5	0.7	0.146	2	0.0
45–59	532,616	94	0.2	52.5	0.7	0.146	10	0.0
60–69	227,854	182	0.8	65.0	0.7	0.146	20	0.1
70–79	107,134	149	1.4	75.0	0.7	0.146	16	0.2
80+	68,104	170	2.5	85.0	0.7	0.146	18	0.3
Total	2,894,797	622	0.2	69.6	0.7	0.146	67	0.02

Table S17 Calculation of YLL in Philippines without using a discount rate

	Population	Deaths	Deaths per 1,000	Av. age at death	Standard LE	YLLs	YLL per 1,000
Men							
0–4	6,484,278	0	0.00	2.6	79.9	1,000	0
5–9	6,230,989	0	0.00	7.3	73.1	1,000	0
10–14	5,925,212	0	0.00	12.9	67.5	1,000	0
15–19	5,532,556	0	0.00	18.1	62.4	1,000	0
20–24	5,038,813	0	0.00	22.5	57.9	1,000	0
25–29	4,678,571	1	0.00	27.5	53.0	1,000	79
30–34	4,286,702	7	0.00	32.6	48.0	1,000	344
35–39	3,732,328	13	0.00	37.5	43.1	1,000	579
40–44	3,105,020	29	0.01	42.6	38.1	1,000	1,121
45–49	2,585,574	67	0.03	47.7	33.2	1,000	2,239
50–54	2,126,761	141	0.07	52.6	28.5	1,000	4,021
55–59	1,692,131	226	0.13	57.6	23.9	1,000	5,412
60–64	1,301,684	297	0.23	62.7	19.5	1,000	5,803
65–69	907,951	366	0.40	67.7	15.4	1,000	5,641
70–74	616,360	388	0.63	72.6	11.8	1,000	4,585
75–79	378,593	300	0.79	77.5	8.8	1,000	2,653
80–84	195,091	206	1.06	82.4	6.4	1,000	1,315
85+	92,955	116	1.25	89.0	3.9	1,000	450
Total	54,911,569	2,160	0.04	68.4	15.9		34,242

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	Population	Deaths	Deaths per 1,000	Av. age at death	Standard LE		YLLs	YLL per 1,000
Women								
0–4	6,210,439	0	0.00	2.6	82.4	1.000	0	0.0
5–9	5,982,874	1	0.00	7.4	75.6	1.000	87	0.0
10–14	5,698,679	0	0.00	12.6	70.4	1.000	0	0.0
15–19	5,328,823	0	0.00	17.9	65.2	1.000	0	0.0
20–24	4,862,680	0	0.00	22.6	60.5	1.000	0	0.0
25–29	4,517,971	1	0.00	27.5	55.7	1.000	40	0.0
30–34	4,144,840	3	0.00	32.6	50.7	1.000	139	0.0
35–39	3,635,615	4	0.00	37.5	45.9	1.000	204	0.1
40–44	3,028,348	13	0.00	42.7	41.0	1.000	523	0.2
45–49	2,622,893	28	0.01	47.7	36.2	1.000	1,003	0.4
50–54	2,278,266	64	0.03	52.6	31.6	1.000	2,016	0.9
55–59	1,937,950	84	0.04	57.7	26.9	1.000	2,260	1.2
60–64	1,559,774	110	0.07	62.6	22.5	1.000	2,471	1.6
65–69	1,083,170	123	0.11	67.6	18.2	1.000	2,235	2.1
70–74	781,401	133	0.17	72.6	14.1	1.000	1,878	2.4
75–79	534,903	113	0.21	77.6	10.5	1.000	1,190	2.2
80–84	309,166	76	0.24	82.6	7.5	1.000	569	1.8
85+	186,552	47	0.25	90.0	4.3	1.000	199	1.1
Total	54,704,344	798	0.01	68.2	18.6		14,815	0.3
Men								
0–4	6,484,278	0	0.0				0	0.0
5–14	12,156,201	0	0.0				0	0.0
15–29	15,249,940	1	0.0	27.5			79	0.0
30–44	11,124,050	50	0.0	39.8			2,044	0.2
45–59	6,404,466	434	0.1	54.5			11,672	1.8
60–69	2,209,635	664	0.3	65.4			11,444	5.2
70–79	994,953	688	0.7	74.7			7,238	7.3
80+	288,046	322	1.1	84.8			1,765	6.1
Total	54,911,569	2,160	0.0	68.4			34,242	0.6
Women								
0–4	6,210,439	0	0.0				0	0.0
5–14	11,681,553	1	0.0	7.4			87	0.0
15–29	14,709,474	1	0.0	27.5			40	0.0
30–44	10,808,803	20	0.0	40.1			866	0.1
45–59	6,839,109	176	0.0	54.3			5,280	0.8
60–69	2,642,944	232	0.1	65.3			4,706	1.8
70–79	1,316,304	246	0.2	74.9			3,068	2.3
80+	495,718	122	0.2	85.4			768	1.5
Total	54,704,344	798	0.0	68.2			14,815	0.3

Table S18 Calculation of YLD in Philippines without using a discount rate

	Population	Incident cases	Incidence per 1,000	Age at onset	Duration (years)	Disability weight	YLDs	YLD per 1,000
Men								
0-4	6,484,278	0	0.0	10.0	0.7	0.146	0	0.0
5-14	12,156,201	90	0.0	22.5	0.7	0.146	10	0.0
15-29	15,249,940	616	0.1	37.5	0.7	0.146	66	0.0
30-44	11,124,050	2,651	0.4	52.5	0.7	0.146	284	0.0
45-59	6,404,466	3,663	1.7	65.0	0.7	0.146	392	0.2
60-69	2,209,635	4,463	4.5	75.0	0.7	0.146	478	0.5
70-79	994,953	1,154	4.0	85.0	0.7	0.146	123	0.4
80+	288,046	12,724	0.2	65.7	0.7	0.146	1,362	0.02
Total	54,911,569	88	0.0	2.5	0.7	0.146	9	0.0
Women								
0-4	6,210,439	0	0.0	2.5	0.7	0.146	0	0.0
5-14	11,681,553	0	0.0	10.0	0.7	0.146	0	0.0
15-29	14,709,474	109	0.0	22.5	0.7	0.146	12	0.0
30-44	10,808,803	590	0.1	37.5	0.7	0.146	63	0.0
45-59	6,839,109	1,205	0.2	52.5	0.7	0.146	129	0.0
60-69	2,642,944	1,305	0.5	65.0	0.7	0.146	140	0.1
70-79	1,316,304	1,331	1.0	75.0	0.7	0.146	142	0.1
80+	495,718	670	1.4	85.0	0.7	0.146	72	0.1
Total	54,704,344	5,209	0.1	63.2	0.7	0.146	557	0.01